**AXM762-COM**
10GBASE-LR SFP+, 1310nm, SMF, 10km, Dual LC, DOM for Netgear

# AXM762-COM

## 10Gbps SFP+ Optical Transceiver, 10km Reach

## Features

- Optical interface compliant to IEEE 802.3ae 10GBASE-LR
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- 1310nm DFB transmitter, PIN photo-detector
- Operating case temperature: 0 to 70 °C
- Low power consumption
- Applicable for 10km SMF connection
- All-metal housing for superior EMI performance
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth

## Applications

- 10GBASE-LR at 10.3125Gbps
- 10GBASE-LW at 9.953Gbps
- Other optical links

## Description

This 1310 nm DFB 10G SFP+ transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km.

The SFP+ LR module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

In the transmit direction, the SFP+ transceiver module receives a 10.3125 Gb/s electrical signal (signaling rate) from the host board Asic/SerDes and converts the data to an optical signal via the

Laser Driver that controls the Laser diode in the Transmitter Optical Sub-Assembly (TOSA). An open collector compatible Transmit Disable (Tx_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (TFault) is provided. TX_Fault is module outputs contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

The 3rd functional capability of the SFP+ module is the 2 wire serial, I2C, interface. I2C is used for serial ID, digital diagnostics, and module control functions. The enhanced digital diagnostics monitoring interface allows real time access to the device allowing monitor of received optical power, laser bias current, laser optical output power, etc.

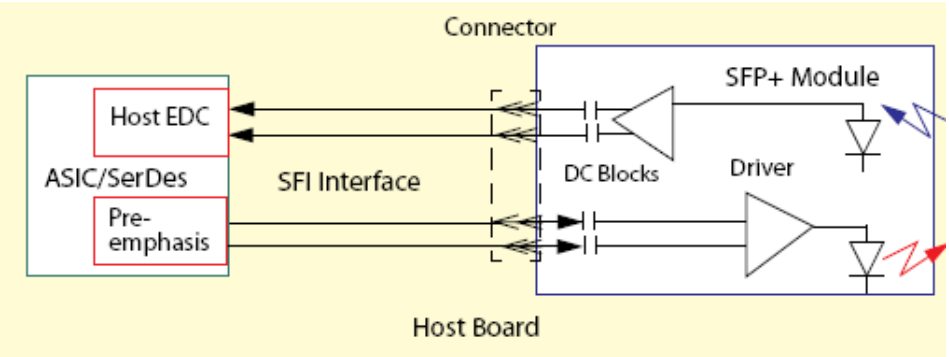



**Figure 1: Interface to Host**

## Pin definition

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 2 and contact definitions are given in Table 2. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 3 and the contact sequence order listed in Table 2.

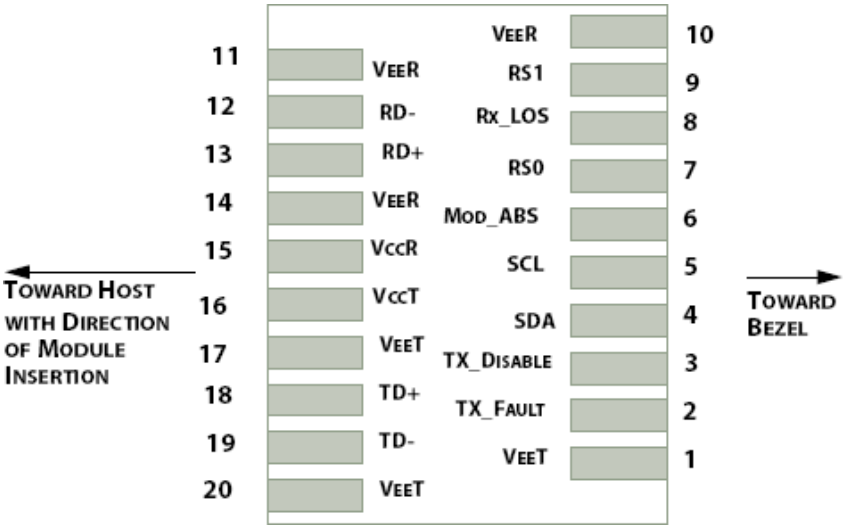



**Figure 2: Interface to Host PCB**

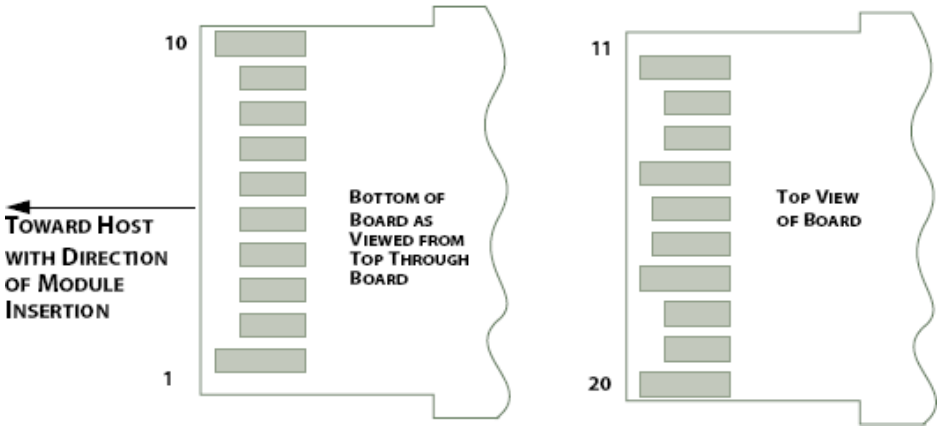



**Figure 3: Module Contact Assignment**

| Pin | Symbol | Name/Description |
|---|---|---|
| 1 | VEET [1] | Transmitter Ground |
| 2 | Tx_FAULT [2] | Transmitter Fault |
| 3 | Tx_DIS [3] | Transmitter Disable. Laser output disabled on high or open |
| 4 | SDA [2] | 2-wire Serial Interface Data Line |
| 5 | SCL [2] | 2-wire Serial Interface Clock Line |
| 6 | MOD_ABS [4] | Module Absent. Grounded within the module |
| 7 | RS0 [5] | RS0 for Rate Select: Open or Low = Module supports ≤4.25Gbps<br>High = Module supports 9.95 Gb/s to 10.3125 Gb/s |
| 8 | RX_LOS [2] | Loss of Signal indication. Logic 0 indicates normal operation |
| 9 | RS1 [5] | No connection required |
| 10 | VEER [1] | Receiver Ground |
| 11 | VEER [1] | Receiver Ground |
| 12 | RD- | Receiver Inverted DATA out. AC Coupled |
| 13 | RD+ | Receiver DATA out. AC Coupled |
| 14 | VEER [1] | Receiver Ground |
| 15 | VCCR | Receiver Power Supply |
| 16 | VCCT | Transmitter Power Supply |
| 17 | VEET [1] | Transmitter Ground |
| 18 | TD+ | Transmitter DATA in. AC Coupled |
| 19 | TD- | Transmitter Inverted DATA in. AC Coupled |
| 20 | VEET [1] | Transmitter Ground |

**Table 2: SFP+ Module PIN Definition**

## Absolute maximum rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 0 | +3.6 | V |
| Storage Temperature | Tc | -40 | +85 | °C |
| Operating Case Temperature | Tc | 0 | +70 | °C |

| | | | | |
|---|---|---|---|---|
| Relative Humidity | RH | 5 | 95 | % |
| RX Input Average Power | Pmax | - | 0 | dBm |

**Table 3: Absolute Maximum Rating**

## Recommended operating environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameter | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 3.135 | 3.300 | 3.465 | V |
| Operating Case Temperature | $T_C$ | 0 | 25 | 70 | °C |

**Table 4: Recommended Operating Environment**

## Optical characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| | Unit | Values | |
|---|---|---|---|
| Operating Reach | m | 10K | |
| Transmit | | | |
| Center wavelength (range) | nm | 1260 -1355 | |
| Side Mode Suppression Ratio (min) | dB | 30 | |
| Launched power | | | |
| – maximum | dBm | +0.5 | |
| – minimum | dBm | -8.2 | Notes1 |
| – OMA | dBm | -5.2 | |
| – OMA-TDP (min) | dBm | -6.2 | |
| Transmitter and dispersion penalty | dB | 0 | Notes4 |
| Average launch power of OFF transmitter (max) | dBm | -30 | |
| Extinction ratio (min) | dB | 3.5 | Notes2 |
| RIN12 OMA (max) | dB/Hz | -128 | |
| Optical Return Loss Tolerance (min) | dB | 12 | |
| Receiver | | | |
| Center wavelength (range) | nm | 1260-1355 | |
| Receive overload (max) in average power[1] | dBm | 0.5 | |
| Receive sensitivity (min) in average power[1] | dBm | -14.4 | Notes3 (10km) |
| | dBm | -13.4 | Notes3 (20km) |
| Receiver sensitivity (max) in OMA (footnote 2) | dBm | -12.6 | Notes3 (10km) |
| | dBm | -11.6 | Notes3 (20km) |

| | | |
|---|---|---|
| Receiver Reflectance (max) | dB | -12 |
| Stressed receiver sensitivity (max) in OMA[2] | dBm | -10.3 |
| Vertical eye closure penalty (min)[3] | dB | 2.2 |
| Stressed eye jitter (min)[2] | UIp-p | 0.7 |
| Receive electrical 3dB upper cutoff frequency (max) | GHz | 12.3 |
| Receiver power (damage, Max) | dBm | 1.5 |

Notes:

1. The optical power is launched into SMF
2. Measured with a PRBS $2^{31}$-1 test pattern@10.3125Gbps
3. Measured with a PRBS $2^{31}$-1 test pattern@10.3125Gbps BER≤$10^{-12}$
4. In G.652 and G.655(NDSF)

**Table 5: Optical Characteristics**

## Electrical characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Data Rate | | - | 10.3125 | - | Gbps | |
| Power Consumption | | - | 1200 | 1500 | mW | |
| **Transmitter** | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | - | 4.0 | V | |
| C common mode voltage | | 15 | - | - | mV | |
| Tx Input Diff Voltage | VI | 400 | | 1600 | mV | |
| Tx Fault | VoL | -0.3 | | 0.4 | V | At 0.7mA |
| Data Dependent Input Jitter | DDJ | | | 0.10 | UI | |
| Data Input Total Jitter | TJ | | | 0.28 | UI | |
| **Receiver** | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | - | 4.0 | V | |
| Rx Output Diff Voltage | Vo | 300 | | 850 | mV | |
| Rx Output Rise and Fall Time | Tr/Tf | 30 | | | ps | 20% to 80% |
| Total Jitter | TJ | | | 0.70 | UI | |
| Deterministic Jitter | DJ | | | 0.42 | UI | |

**Table 6: Electrical Characteristics**

## Control and status I/O timing characteristics

Timing characteristics of control and status I/O are included in Table 7, which is also defined in SFF-8431.

| *Parameter* | *Symbol* | *Min.* | *Max.* | *Unit* | *Conditions* |
|---|---|---|---|---|---|
| TX_Disable assert time | t_off | | 100 | µs | rising edge of TX_Disable to fall of output signal below 10% of nominal |
| TX_Disable negate time | t_on | | 2 | ms | Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery. |
| Time to initialize 2-wire interface | t_2w_start_up | | 300 | ms | From power on or hot plug after the supply meeting Table 8. |
| Time to initialize | t_start_up | | 300 | ms | From power supplies meeting Table 8 or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational. |
| Time to initialize cooled module | t_start_up_cooled | | 90 | s | From power supplies meeting Table 8 or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational. |
| Time to Power Up to Level II | t_power_level2 | | 300 | ms | From falling edge of stop bit enabling power level II until non-cooled module is fully operational |
| Time to Power Down from Level II | t_power_down | | 300 | ms | From falling edge of stop bit disabling power level II until module is within power level I requirements |
| TX_Fault assert | TX_Fault_on | | 1 | ms | From occurrence of fault to assertion of TX_Fault |
| TX_Fault assert for cooled module | TX_Fault_on_cooled | | 50 | ms | From occurrence of fault to assertion of TX_Fault |
| TX_Fault Reset | t_reset | 10 | | µs | Time TX_Disable must be held high to reset TX_Fault |
| RS0, RS1 rate select timing for FC | t_RS0_FC, RS1_FC | | 500 | µs | From assertion till stable output |
| RS0, RS1 rate select timing non FC | t_RS0, t_RS1 | | 10 | ms | From assertion till stable output |
| Rx_LOS assert delay | t_los_on | | 100 | µs | From occurrence of loss of signal to assertion of Rx_LOS |
| Rx_LOS negate delay | t_los_off | | 100 | µs | From occurrence of presence of signal to negation of Rx_LOS |

**Table 7: Timing Characteristics**

## Mechanical dimensions:

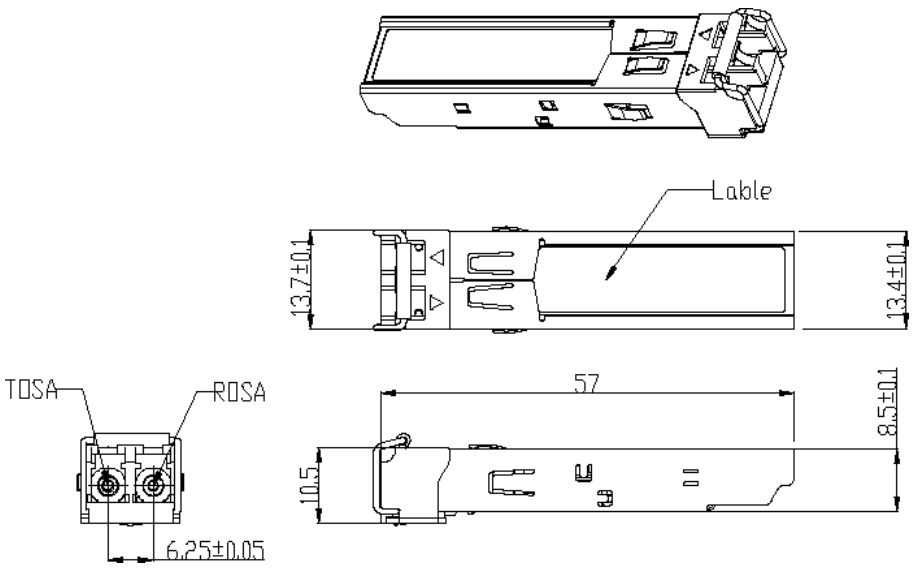



**Table 8: Key Mechanical Dimensions**

## ESD

This transceiver is specified as ESD threshold 1kV for high speed pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## Ordering information

| Part Number | Product Description |
|---|---|
| AXM762-COM | 1310nm, 10Gbps, 10km, 0ºC ~ +70ºC |